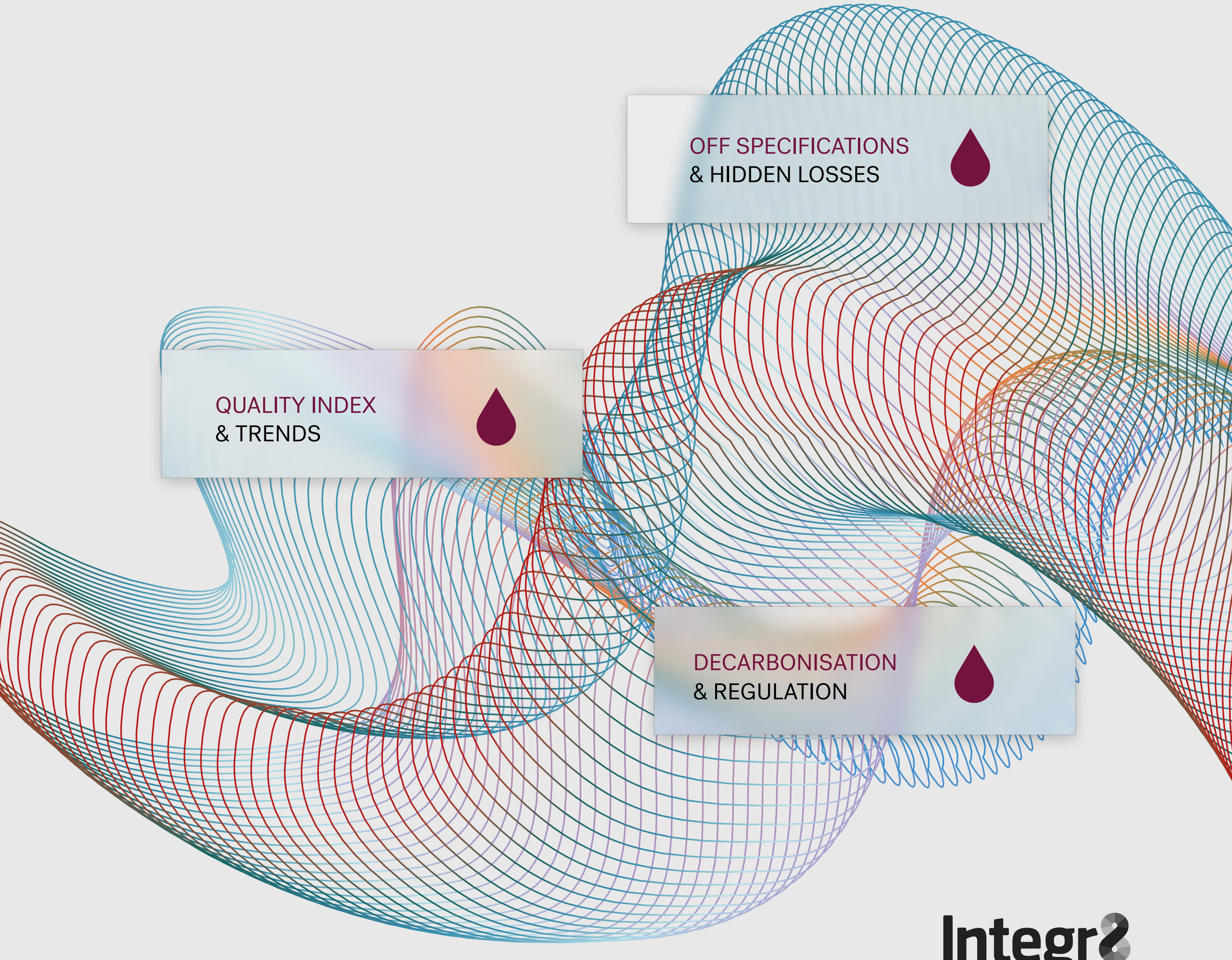
Bunker Quality Trends

Nov 2023

Challenges fueling change.



Integr8 Fuels

Introduction:
Challenges fueling change

As we come to the end of another year in the world of bunkers that seems to have passed with the blink of an eye, our minds shift towards the challenges on the horizon and how as an industry we need to embrace change to profit and succeed in the future.

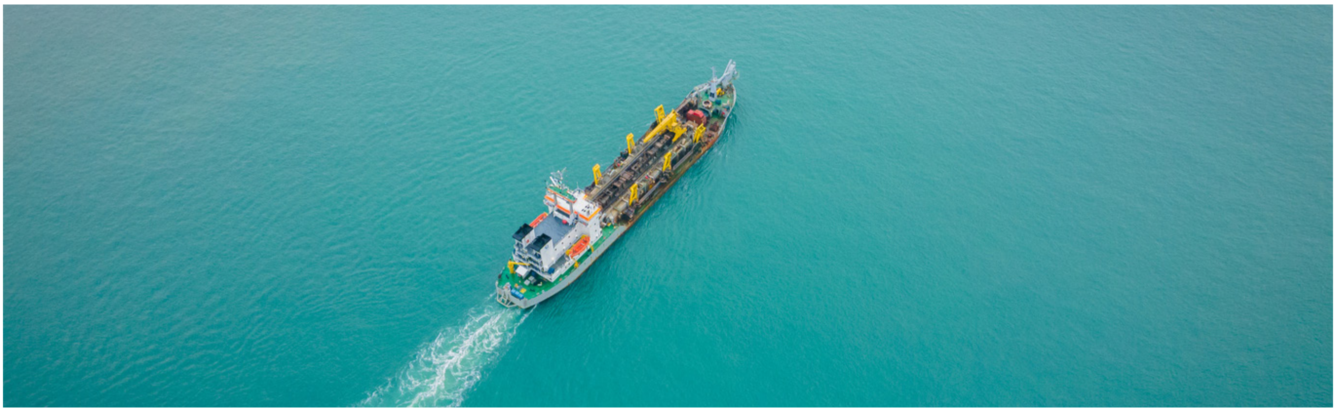
This is the third Integr8 Fuels quality report covering the last six months of supplies globally where we again dissect and compare the likelihood of hidden losses and off specification issues across all commercial grades of bunkers and key ports.

Using 'best in class' available data from over 120 million metric tons (MT) of deliveries globally across 1,300 locations and from over 800 suppliers, we will also assess fuel quality trends using our own Integr8 Quality Index which scores the proximity (or otherwise) of individual parameters within each sample to the relevant table 1 or table 2 specification limits within ISO 8217.

Finally, given the context of the incoming changes we will consider some of the challenges that decarbonisation and verification of emissions will bring to the industry.

Data Used in This Report

+120m	1,300	+800
MTs of Deliveries	Global Locations	Suppliers



Part 1:

Off specification frequencies

How likely are we to be faced with an off specification situation?

In the last 180 days, owners' analysis available to Integr8 Fuels has highlighted that you are equally likely to have an off specification issue* with marine gas oil (MGO) as with high sulphur fuel oil (HSFO) with very low sulphur fuel oil (VLSFO) being one third less likely (see figure 1).

Grade	Off Spec %	Compliance Off Spec %	Critical Off Spec %	High Risk Off Spec %	Low Risk Off Spec %
HSFO	3.0 (+0.1)	0.1 (-0.1)	0.3 (-0.1)	0.4 (-0.2)	2.6 (+0.3)
VLSFO	2.0 (-0.3)	0.6 (-0.1)	0.5 (-0.1)	1.1 (-0.2)	0.9 (-0.1)
MGO**	3.0 (-0.2)	1.8 (-0.2)	0.1 (-0.1)	1.9 (-0.3)	1.1 (+0.1)

Figure 1: Types and frequencies of off specification incident by grade (excluding biofuel blends)

*Beyond 95% confidence for a parameter listed in table 1 or table 2 of ISO 8217:2010

**Data includes pour point off specifications in Singapore (which is not routinely guaranteed)

What is the likelihood of receiving non-compliant or critically off spec bunkers?

It is always important to consider the context of the off specification incidents.

To do this it is essential to consider the likelihood of MARPOL Annex VI (sulphur) or SOLAS (flash point) infractions and the likelihood of critical off specification incidents such as cat fines, total sediment potential, used lubricating oils, sodium and ash content (high risk) against routine and easily rectifiable off specification issues classified “low risk” such as a high viscosity in HSFO.

The rule of thumb when comparing off specification incidents by grade is that the parameters targeted in any blending model are the most likely to be outside the specification. For example, VLSFOs are targeted on sulphur, with the price difference for 50,000MT of fuel with a sulphur content of 0.49 compared to 0.45 possibly equating to hundreds of thousands of dollars. It’s hardly surprising, therefore, that both VLSFO and MGO, both of which are blended to a sulphur target, have more prevalence of MARPOL Annex VI non-compliances at 0.5% and 0.1% respectively.

However, MARPOL Annex VI is not the only compliance issue - we cannot ignore the requirement for flash point being 60°C or above as demanded by SOLAS. Indeed, off specification flash point, particularly with LSMGO, may be an unintended consequence of pulling low sulphur automotive or inland grades into the bunker pool as identified later in this paper.

High risk off specification incidents, defined as the total of both compliance and high risk off specifications, are seen to be most prevalent in MGO followed by VLSFO and, finally, HSFO. In fact, if you strip out compliance off specification, incidents relating to total sediment potential (TSP), aluminium and silicon (Al+Si) etc. for residual grades are very low indeed.

That said, there are many nuances, from region to region, to port-to-port, and even supplier-to-supplier at the same location. It therefore remains essential to consider these when buying bunkers and we will address some of the challenges later in the paper.

Availability of products (September 2023)

Unsurprisingly, marine gas oil is the most available product (640 ports) given the ability to substitute and supply higher quality inland or automotive grades and logistical ease of supplying what are quite often small quantities.

VLSFO is also seen to be readily available across all continents but at 28% fewer ports (458 ports), this because of larger quantities being ordered and the storage and barge infrastructure to support these supplies in general.

High sulphur fuel oil is the only product which is not readily available, with only 231 ports listed as of September 2023 (see figure 2). HSFO availability is centered around bunkering hubs and geographically key areas likely to receive passing trade from VLCCs and / or other scrubber fitted sectors. It is important, therefore, to plan carefully for HSFO and consider the type of scrubber fitted to the vessel along with any local limitations in forthcoming voyages that may require a fuel switch to LSMGO, for example.

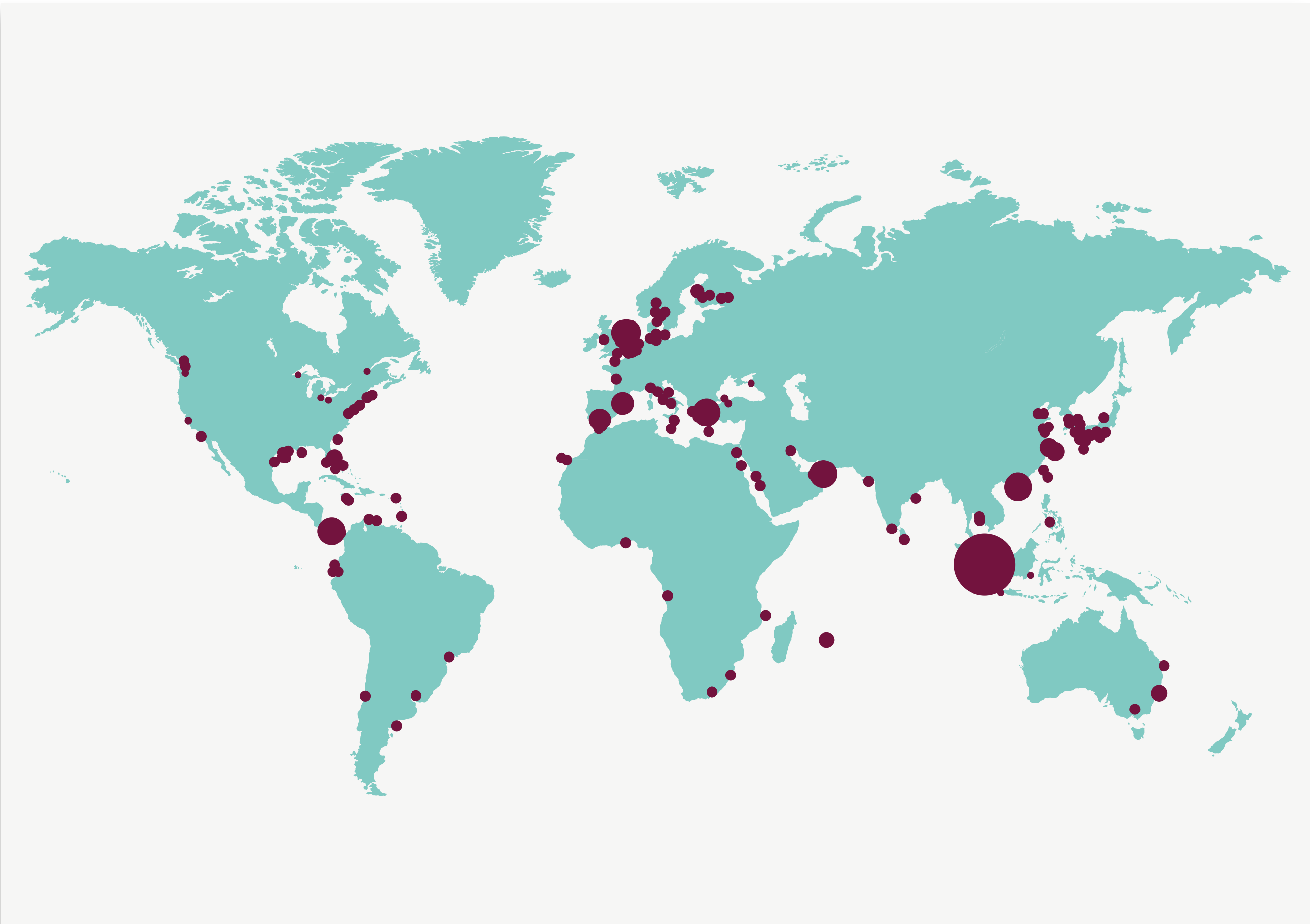


Figure 2: Availability of HSFO 380 September 2023

Biofuel blends

Data is now becoming available for tests of identified biofuels supplied globally* and whilst this is still very small in comparison with conventional fuels, it is clear to see the apparent void stretching from Singapore to Europe currently present.

Moreover, we are not currently able to comment on the sustainability of the biofuels being supplied but can confidently predict that Indonesia fuels, for example, will likely be sourced from palm oil and would not satisfy a verifier of emissions. ARA, and in particular Rotterdam, is seen to be the epicenter of supply in Europe given the current subsidies available in the Netherlands. VLSFO blends are almost exclusively limited to bunker hubs.

Figure 3: Availability of biofuels and biofuel blends (all grades)

* Fuels identified with FAME present > 7%

Which specifications are being traded?

Even as we eagerly anticipate the new version of ISO 8217 hopefully expected in early 2024, we continue to work in the past when it comes to the specifications we buy and sell on a day-to-day basis.

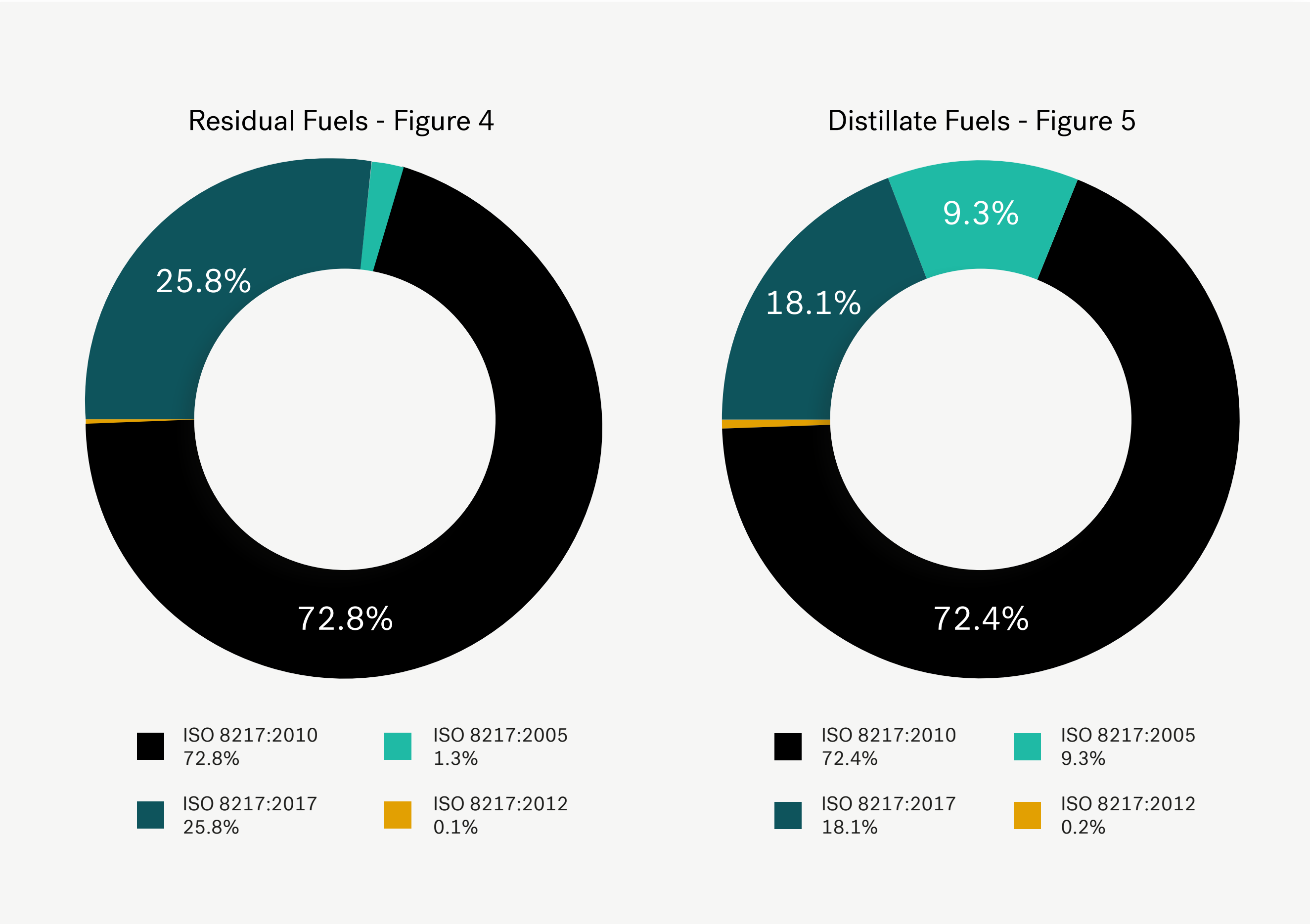
The scale of the challenge can be laid bare by considering the charts below, (figures 4 and 5), which identify the split of residual and distillate ISO 8217 grades traded by product group in the last 180 days.

Residual Fuels

Just over one quarter of trades are guaranteed to the latest version of the specification (2017) which is virtually unchanged compared to previous figures.

Distillate Fuels

In the case of MGO, only 18% of fuels traded were sold as 2017 fuels in the last 180 days, slightly less than previous. A very slight reduction in 2005 fuels was noted from 11% to 9%, however it is worth remembering that this specification is nearly 19 years old.



Figures 4 and 5: Guaranteed specifications (last 180 days)

Challenges fueling change: The uptake of new specifications

Presenting this data on traded specifications to a stakeholder from outside of the marine industry would be staggering, with over three quarters of all fuels being sold to an obsolete specification.

In previous reports we have discussed the reasoning behind this, now we will look at the impact of not taking on board the lessons learned going forwards.

William Wordsworth, a famous English poet, once wrote: "Life is divided into three terms – that which was, which is, and which will be. Let us learn from the past to profit by the present, and from the present, to live better in the future."

Using ice cream as an example, we have gone from the days of vanilla trades (HSFO) through to a multitude of flavours and toppings post IMO 2020 with all the different make ups of VLSFO, and now (for our Singapore readers), we are about to throw in a durian sorbet or two with the incoming spectrum of alternative fuels.

These challenges will fuel change in all we do, not least moving us from a world of opacity to one of transparency and traceability, however, to do this we need to move with the times and, as a matter of some urgency, incorporate the new specifications due in early 2024.

But this requires one key requirement which is 'buy in'. Buy in from the manufacturer and blender, who should be willing to sell to the guarantees of ISO 8217:2024. This in turn will allow the buyers and resellers to guarantee these to their customers, and ultimately, the end user.

Previous reticence in the latest specification was that, from an owner's perspective, there was no material benefit (or perceived benefit) to fuel vessels with 2017 material. This should not be the case given the need for transparency and verification of emissions, so I expect this to migrate its way into charter parties, break the rinse and repeat cycle of the industry trading obsolete specifications and in the words of William Wordsworth "live better in the future".

Part 2:
Integr8 Quality Index

The Integr8 Quality Index is a high-level index which allows a comparison by port, supplier and grade against key quality parameters and their proximity to the specification. It is important to note that the quality index not only picks up on 'off specification' incidents beyond 95% confidence but also fuels that are within limits but close to the specification.

In the last six months the quality index for HSFO has seemed to improve, this explained by a reduction in high-risk claims such as TSP and AlSi. VLSFO is seen to be almost at parity with the previous period, with gas oil (despite showing some improvement) falling back to similar levels in recent months (see figure 6).

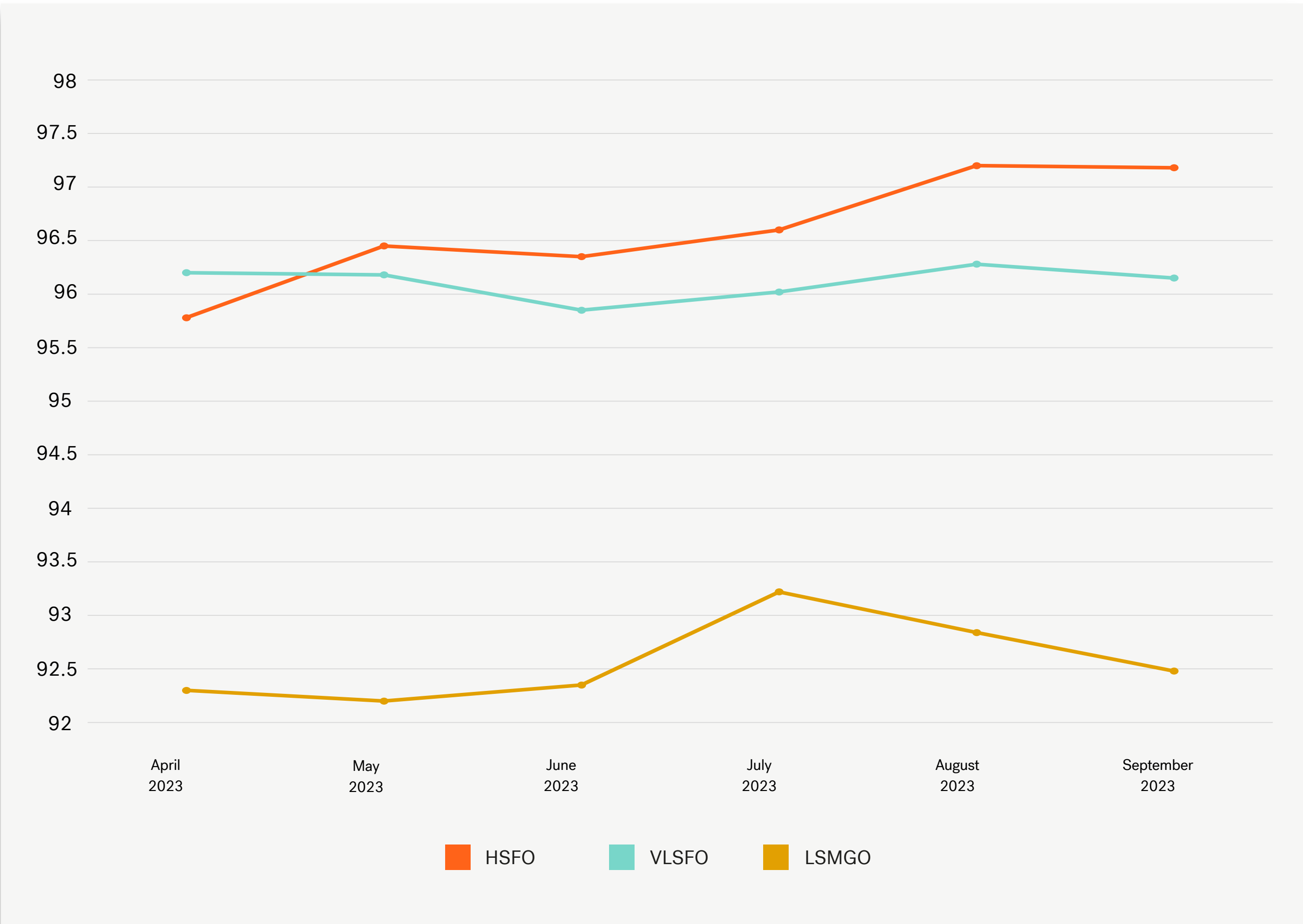


Figure 6: Integr8 Quality Index for HSFO, VLSFO & MGO

Focus on HSFO

3.0% of all HSFO supplies tested outside of specification (and beyond 95% confidence limits) for ISO 8217 table 2 parameters in the last 180 days, this slightly up from 2.9% when compared to previous.

The data identifies that the risk of elevated sulphur (above 3.5% Wt.) or flash point (SOLAS) compliance is very low, and based on the cross section of off specifications, we can identify the hit rates of high risk off specification matters such as Al+Si and TSP at extremely low levels (see figure 7) in real terms around one supply per thousand each.

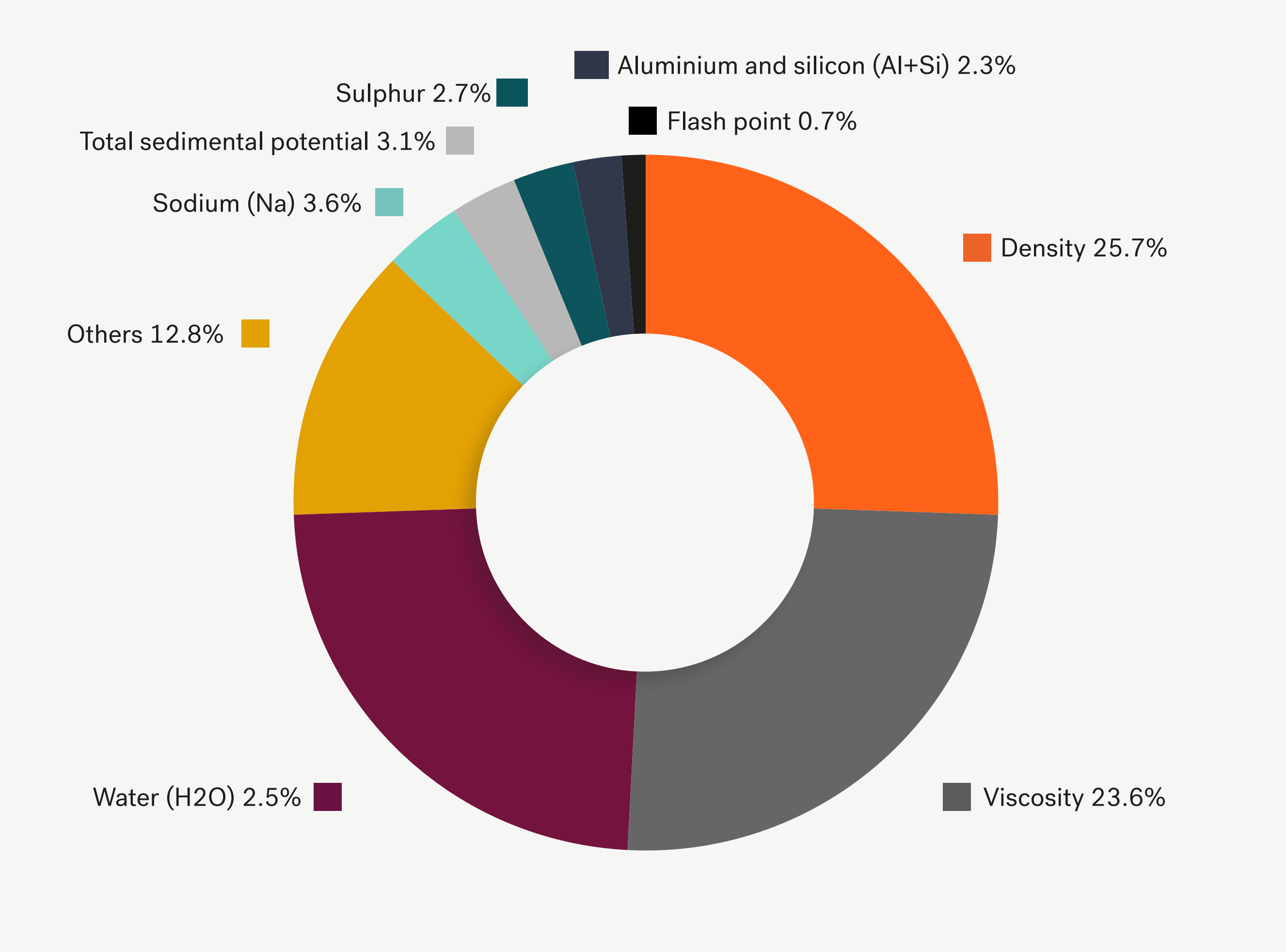


Figure 7: HSFO off specification distribution by parameter

In the last 180 days, half of all off specifications are what can be termed blending related, i.e., against the limit of 0.991 Kg/Ltr for density or 380 cSt for viscosity. In other words, a fuel will be actively made worse, or optimised against these limits to reduce the cost of the barrel and hence increasing profit between wholesale and retail.

Interestingly, both blending targets are not always in play and as a result significant differences can be seen when comparing bunker hubs. For example, in ARA HSFO density is targeted which results in 24 times more off spec density claims in this region than in Singapore (see figure 8).

Conversely, elevated water is more prevalent in Singapore HSFO than in ARA ports, this borne out by the average water measured being 25% higher than ARA at 0.20% Vol. Given that most off specifications are very marginal and it would not generally cause operational difficulties to remove the excess via purification onboard, we may consider these water levels more from the perspective of hidden financial losses which for a relatively small demand for a fleet can quickly exceed hundreds of thousands of dollars per annum (see figure 9).

Turning to other parameters and considering Panama, the number of samples with elevated viscosities in RMG380 has been very significant. However, given the highest result obtained over the period was 436 cSt, this does not overly concern us as this type of situation would usually be handled on board with between a one and three degree C increase to injection temperature at the engine inlet.

Port	Off Spec Hit (%)	Density Hit (%)	Viscosity Hit (%)	Water Hit (%)
ARA	4.0	2.4	0.9	0.3
Singapore	1.4	0.1	0.4	0.8
Fujairah	0.5	0.0	0.0	0.5
Panama	15.4	3.5	10.2	1.8
Gibraltar	0.4	0.0	0.0	0.3

Figure 8: HSFO off specification distribution by parameter

Port	Avg Water (%)	HSFO 380 (USD)	Avg Loss per MT (%)	Avg Loss per 100K MT (USD)	Avg Worse Case Supplier Water (%)	Worse Case Loss per 100K MT (USD)
ARA	0.15	512	0.77	77K	0.22	122K
Singapore	0.20	471	0.94	94.2K	0.38	179K
Fujairah	0.24	465	1.12	112K	0.41	191K
Panama	0.18	552	0.99	99.3K	0.27	149K
Gibraltar	0.15	567	0.85	85.1K	0.24	136K

Figure 9: HSFO hidden losses (water)

Focus on VLSFO

2.0% of all VLSFO supplies tested outside of specification (and beyond 95% confidence limits) in the last 180 days for ISO 8217 table 2 parameters - this a further improvement from 2.3% in the previous report and 2.7% a year ago.

The data identifies that the risk of MARPOL Annex VI non-compliance for VLSFO is significantly higher globally than for HSFO at 0.6%, a fall from 0.7% previously, however this again does not tell the full story given the elevated risk of non-compliance noted around blending hubs.

Based on the cross section of off specifications, we can identify the hit rates of high risk off specification matters such as Al+Si and TSP remain very low at rates of around two supplies per thousand (see figure 10). The risks of issues because of complex blending remains almost exclusively in bunker hubs rather than those areas with either simpler blending models or refined products available.

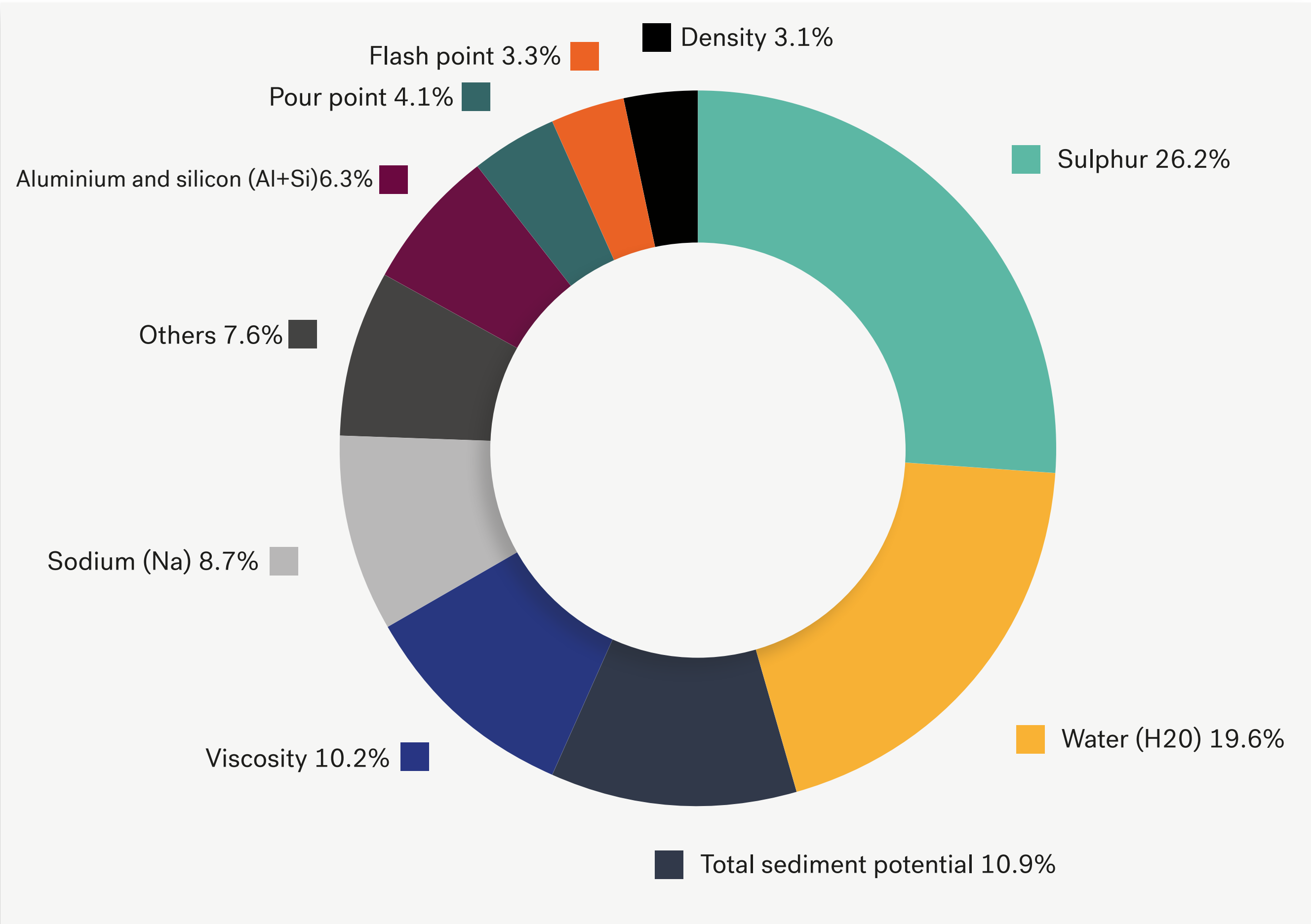


Figure 10: VLSFO off spec distribution by parameter

The cross section of VLSFO claims remains very similar to the last report with almost two thirds of all off specification VLSFO occurrences because of sulphur, water, TSP and cat fine (Al+Si) infractions, although there has been a slight improvement to sulphur compliance from previous levels of a third of all samples being off specification to a figure closer to a quarter in this report. Flash point issues on VLSFO are generally very few and far between and are only noted in under one sample in 1000. Viscosity and density issues are not prevalent to the same level as HSFO due to these not being targets for blending.

It is important to note that this data does not capture any alleged contamination incidents that have been reported from some circles in recent months. From a global standpoint, VLSFO quality (in compliance with table 2 of ISO 8217) remains good, yet significant regional variances can still be noted.

It was previously reported that Belgian and Dutch ports (ARA) were particularly affected with issues relating to sulphur compliance in VLSFO, with a receiver previously 14 times more likely to receive a notification of a VLSFO above 0.50% than in Singapore and more than five times more likely, on average, than other ports in the rest of the world.

Thankfully, we can report that in recent months there has been a significant improvement in ARA although sulphur notifications (above 0.50% S) still six times that of Singapore.

Country	Avg Sulphur Wt. (%)	Tolerance Sulphur 0.51-0.53 Incl. (%)	Off Spec Sulphur (%)
Belgium & Netherlands (ARA)	0.46	2.4 (8.2)	1.2 (3.2)
Rest of the World	0.45	1.1 (1.4)	0.8 (0.7)
Singapore	0.47	0.4 (0.5)	0.2 (0.3)

Figure 11: % of deliveries last 180 days with sulphur tested in categories specification +95% confidence or off specification for VLSFO

Focus on VLSFO sulphur non-compliance

As identified in the previous report, we continue to see the same trends with respect to supplier performance which vary wildly from one to another, such as for those based in the ARA region and Italy where we will now look in more detail.

ARA

Focusing on ARA, despite the improvements noted, when we drill down to individual supplier performance level, we can still identify issues. In one anonymised example below, we still note that in the case of April 23 to date, we have strong grounds to believe that for this supplier at least 5% of all deliveries were non-compliant and more recently around 12% of all fuels tested above 0.50% sulphur (see figure 12). Interestingly, when we compare the distribution of results in July 2023 there are far more fuels testing above 0.54% sulphur than testing between 0.51% and 0.53%. This again supports the root cause of these issues as being barges switching from VLSFO to HSFO and back with the first delivery post a HSFO movement almost inevitably testing above 0.53%, no doubt due to the common deck lines (and / or sampling points) on board the barge. This is clearly a substantial risk and one that if identified should continue to be avoided wherever possible, especially when comparing with the greater ARA market in general, which is by no means the worst performing area.

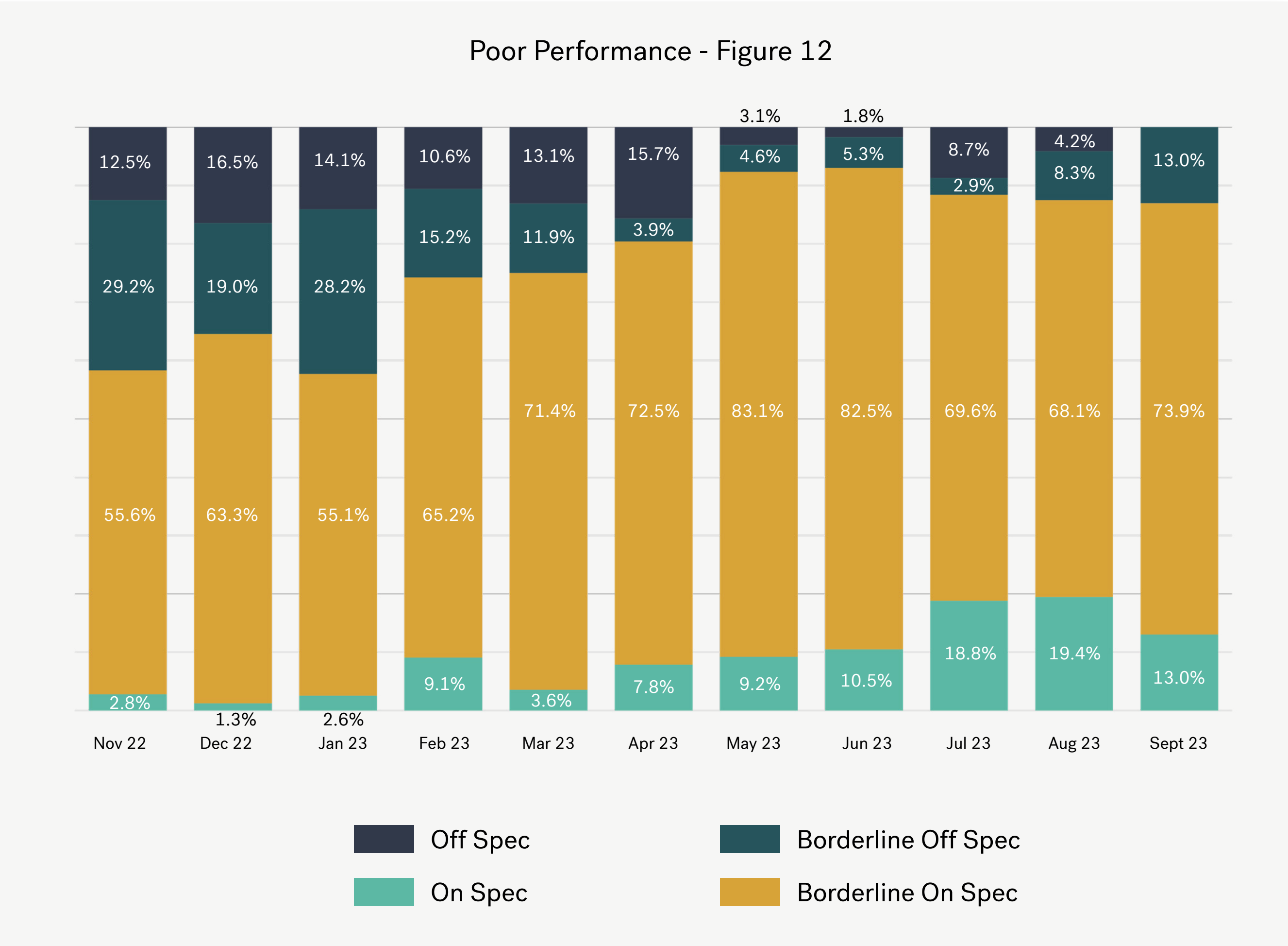


Figure 12: ARA supplier VLSFO sulphur content: inferior performance

Italy

Interestingly, another area in the world that is susceptible to much higher risk for sulphur non-compliance is Italy, with as many as 3.6% of all samples testing at or above the carriage ban of 0.54%.

Yet, on closer investigation we identify some quite horrific hit rates, firstly Civitavecchia where in the last 180 days 50% of owners' analyses have tested above 0.54% as well as Livorno at 12%, Salerno at 10% etc. (see figure 13).

Supplier wise, one particular supplier has a 78% hit rate for such levels of sulphur, yet others perform very well at less than 1%. Rarely will you see such polarised quality trends in the world which reinforces the need to buy very carefully if you are operating in the Italian market and seeking to purchase VLSFO.

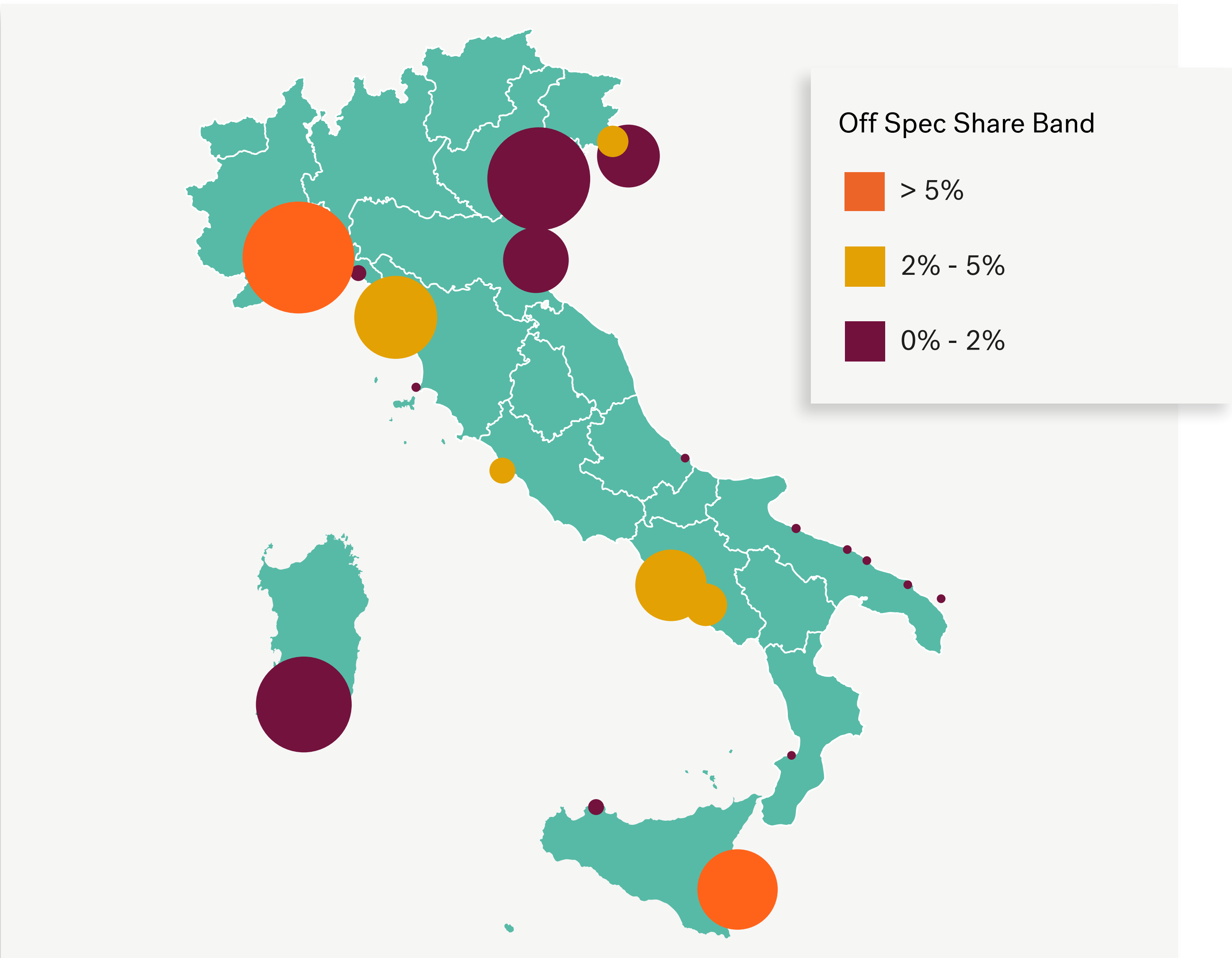


Figure 13: Italy VLSFO off specification sulphur

Water content and a greater risk of non-homogenous VLSFOs

Water content remains the next most likely parameter to be found off specification with around one in five fuels seen to be off specification in the last 180 days, this virtually unchanged, although the global average has increased from historic average lows of 0.14% to around 0.18% volume.

To understand the frequency and the hit and miss nature of these issues, it is important to understand the characteristics of VLSFO and how this may affect the quality of fuels across a supply chain all the way to the end user.

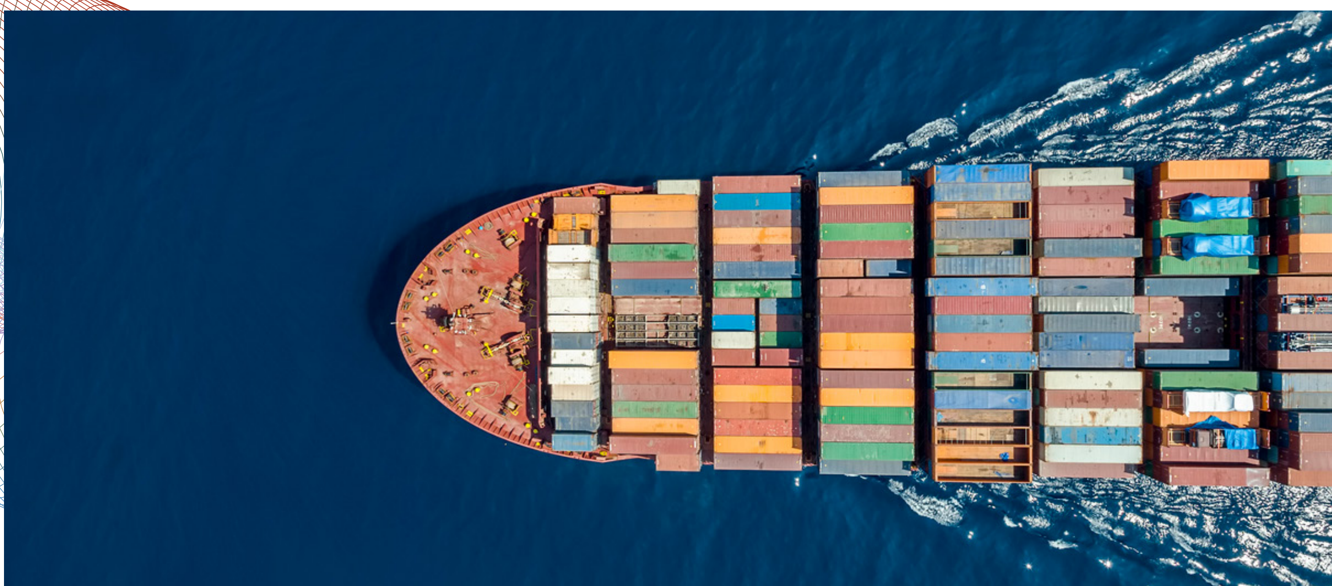
We have already referred to the challenges of various blending models and non-homogeneity is an unintended consequence of ensuring that a fuel complies with the sulphur limit of 0.50%.

The consequence of the water, initially present in suspension, falling out and settling in the storage facility or barge, can be explained by the characteristics of the fuel and the storage conditions that they are subjected to.

VLSFOs are very different to HSFOs in that they are generally more paraffinic, and as a result are waxier and have higher pour points. VLSFOs exhibit much lower viscosities at 50°C (155 cSt) than HSFO (332 cSt). The paraffinic nature also results in much lower densities for VLSFOs (0.945 Kg/Ltr) than HSFO (0.981 Kg/Ltr).

Therefore, VLSFOs are routinely required to be stored at higher temperatures than HSFOs and as a result the low viscosity and the differential between the density of water and the density of the fuel allows the water to separate far easier than in HSFO. Hence with the added effect of heat lowering these further, this increases the potential for insoluble metals, water etc. to settle out or become stratified or layered in the storage facility over time, be it shore tank or barge tank.

These quite significant risks increase the need for key check points during barge loading and as such, even if costs must be passed on to the end user, it would be sensible to check VLSFOs for appreciable changes to shore tank quoted quality which would be a warning a fuel has become non-homogenous.



Focus on MGO

3.0% of all MGO supplies tested outside of specification (and beyond 95% confidence limits) for ISO 8217 table 1 parameters in the last 180 days, this down from 3.2% in the previous report.

The data identifies that the risk of either MARPOL or SOLAS non-compliance is 1.8%, slightly less than previous (2.0%). Drilling into the individual parameters, sulphur remains responsible for around one third of all off specification incidents and flash point slightly reduced by around one quarter (see figure 14).

Concentrating on the legislative requirements for both sulphur and flash point, these are driven by completely different factors.

Sulphur issues are again because of very tight blending to the 0.1% limit with these being so borderline it is not uncommon that, when tested again, these exceed the limit.

Flash point on the other hand is either because of cross contamination, which tends to be rare, or more endemic issues such as the use of road fuels in the marine sector. These are generally characterised by their improved cetane (ignition capabilities) and much lower viscosities due to the increased amount of kerosene in these blends which by default, given kerosene is more volatile, depresses the flash point to a level close (or even below) SOLAS requirements. Indeed during the period around 90% of all off specification MGO flash points reported also had a viscosity less than 3 cSt.

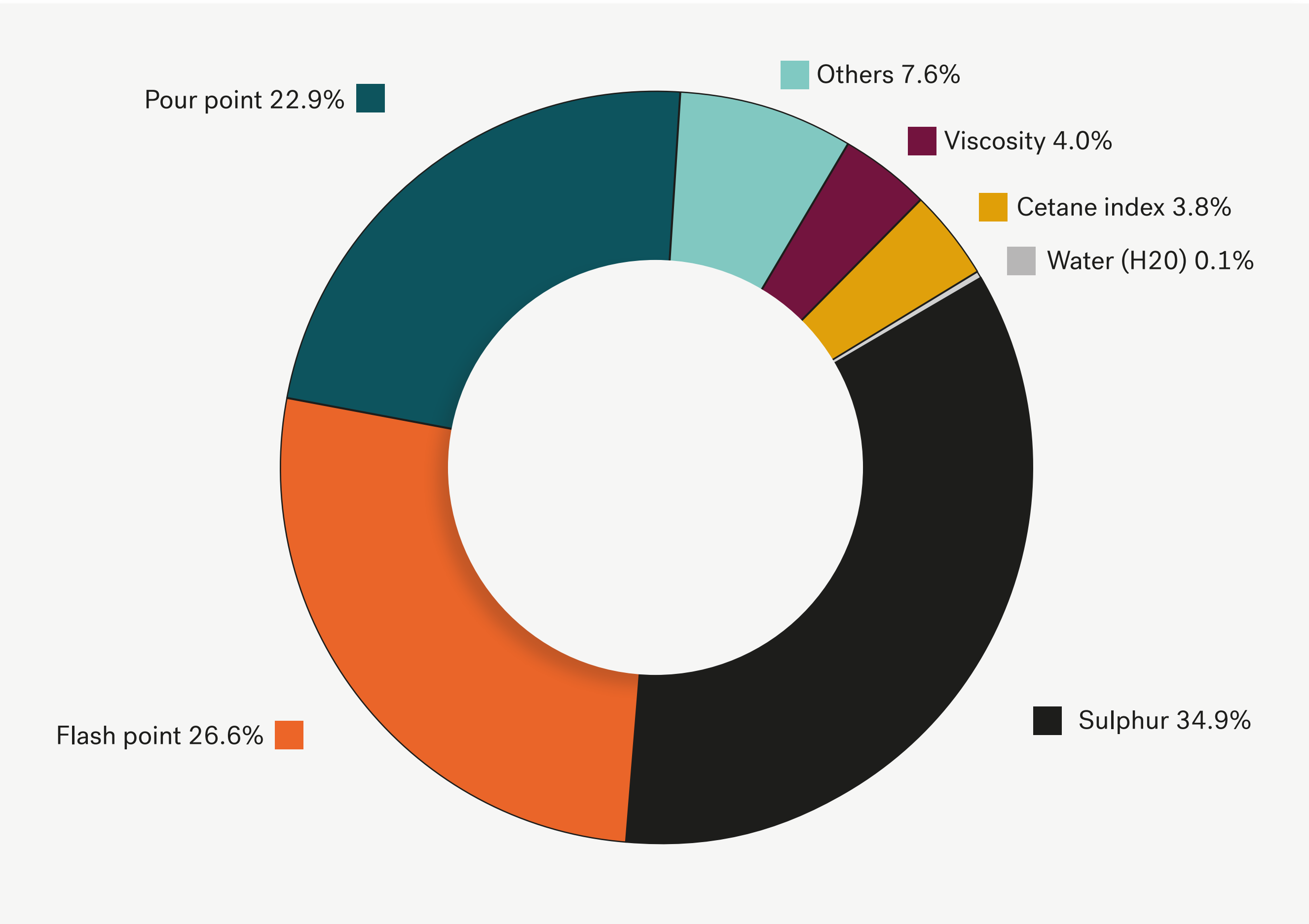


Figure 14: MGO off spec distribution by parameter

SOLAS Regulation II-2/4.2.1 specifies a minimum limit of 60°C for flash point in marine fuels with no tolerance, unless specifically provided for emergency generators, where this limit is 43°C minimum.

The prevalence of these fuels can be easily identified when identifying fuels with certain characteristics, i.e., a flash point less than 60°C and a viscosity less than 3 cst at 40°C. The risks of SOLAS non-compliance are noted to be magnified in certain parts of the world, one such area being Europe in general, but particularly Croatia where automotive grades are being shoehorned into the marine pool resulting in almost one in five samples testing below 60°C.

Pockets of off specification fuels can pop up anywhere, however, Aliaga in Turkey is an excellent example with 36% of all samples (up from 14% previously) testing below 60°C compared to the rest of the country, where only around 1% of samples tested below the same value.

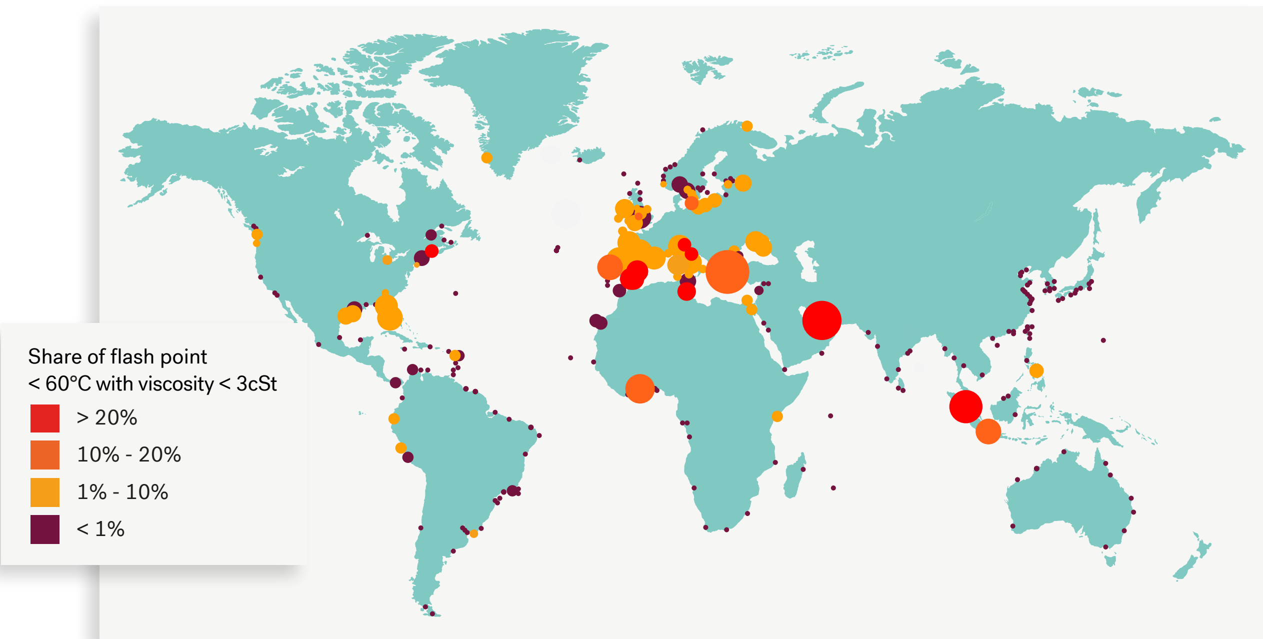


Figure 15: Flash point off specification combined with viscosity <3 cSt

Cold flow properties

As we are now moving towards colder weather in Europe it is wise that our focus should again fall on issues relating to cold flow properties of LSMGO, specifically a lower cost, high density fuel marketed and exported from the ARA region.

Cold flow properties, namely cloud point and cold filter plugging point (CFPP) still have no limits specified in any version of ISO 8217 table 1 but are very relevant when considering the ability to handle fuels on board a vessel (see figure 16).

Firstly, it is important to define these parameters. Cloud point is defined as the temperature where a distillate fuel first forms wax crystals (manifesting as a cloud) when cooled under laboratory conditions, whereas CFPP is defined as the temperature at which a fuel last flows through a 45 micron filter under laboratory conditions.

Cloud point is generally not relevant in that a fuel at or around its cloud point would unlikely cause any operational difficulties. Indeed, heating a fuel beyond its cloud point could cause other issues such as oxidation.

On the other hand, CFPP is very relevant as it provides, albeit under laboratory conditions, a temperature that blocks a 45 micron filter (not to mention that onboard vessel filters are actually much finer than 45 microns).

Importantly, operability on board the vessel will become a challenge at a temperature in-between the cloud point and the cold filter plugging point, far earlier than the point at which the fuel sets or stops pouring (the pour point) which is the only cold flow guarantee available at present.

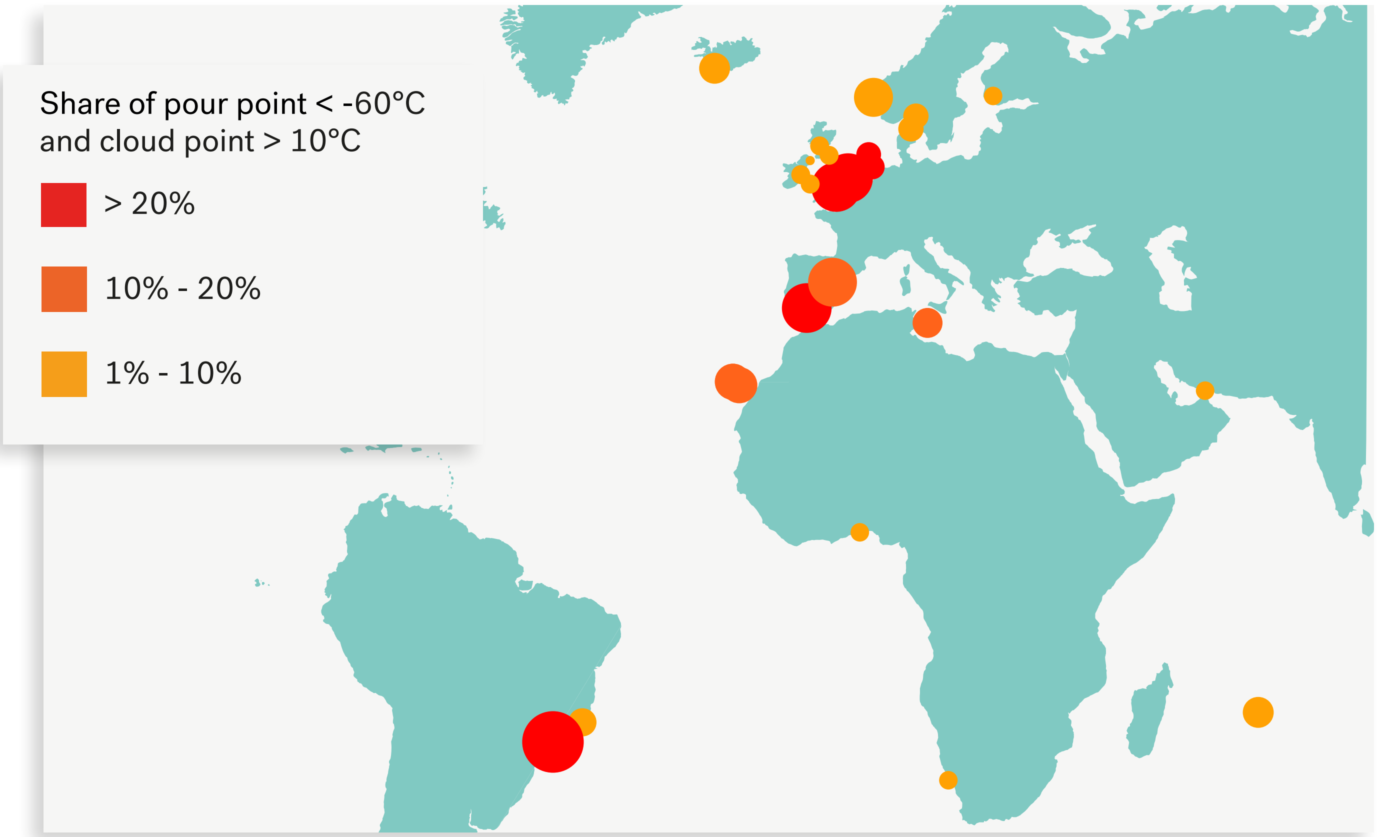


Figure 16: Distribution of fuels with high cloud point (>10°C) and winter grade pour point

The characteristics of the 0.88 LSMGO grade are well known. This fuel is blended with heavy paraffinic components and generally has a density of around 0.88 Kg/Ltr. It has a high viscosity and relatively poor cetane index in comparison with automotive fuels. On a positive note, given its blend make up, it does not exhibit any flash point issues.

But this is where the good news stops. The blend is such that it is routinely additised with middle distillate flow improver which allows the blender to masquerade a summer grade as a winter grade, this identified by the wide delta from cloud point to pour point which is often 17°C or more (cloud point +10, pour point -6°C). Tellingly, suppliers or manufacturers expressly exclude any liability relating to fit for purpose guarantees, but charterers are often exposed given this requirement being routinely written into charter parties.

So, like clockwork, the Northern Hemisphere winter 2023 / 24 is expected to be no different.

Recent data available to Integr8 shows that greater than 20% of fuels currently being supplied have a cloud point to pour point delta of +17 °C and, when delving deeper, the average CFPPs for the month of September (for fuels tested) is 8°C, however worse case values for CFPP of +17°C are noted.

This worse case example is already a cause for concern when considering current sea temperatures, and if fuels continue to be masqueraded, problems may only worsen as we move towards the depths of winter. This is especially true for sectors that exhibit greater risk, for example, where MGO is required for cranes on a geared bulker with fuel lines that are exposed to lower air temperatures.

Most vessels will of course trade globally, potentially in climates far colder than Northwest Europe, therefore, it is essential for buyers to understand the risks and consider where they are heading and whether the situation may make the fuel prone to increased sensitivity to temperature, such as the example of the geared bulker or dredger.

For this reason, unless confident the vessel is heading to warmer climates (and will burn the fuel out in that timeframe) it is recommended to purchase ISO 8217:2017 winter grade in ARA which provides for the reporting of cold flow properties and, as necessary, add a maximum CFPP and / or cloud point into your buying contract. This provides a guarantee sadly missing in all versions of ISO 8217.

Part 3: Biofuel quality

Two main (but very different) types of biofuels are currently available, these being fatty acid methyl ester (FAME) made from a variety of sources such as rapeseed methyl ester (RME), palm (PME) and used cooking oil (UCOME) and, alternatively, hydrotreated vegetable oil (HVO) again produced from similar plant or animal fat-based sources.

The physical characteristics of FAMEs are closer to those of fossil diesel fuels than pure vegetable oils, but properties depend on the feedstocks utilised to produce them. FAMEs must comply with EN14214 in Europe and ASTM D6751 in the USA and can be supplied as blends from B7 (7% biofuel) to B100 (100% biofuel).

Data available to Integr8 has now begun to identify both neat and blended biofuel availabilities and qualities, albeit at relatively low levels (see figure 17).

VLSFO blending with FAME is generally limited presently to the bunker hubs of Singapore and ARA, and in particular Rotterdam which currently benefits from price rebates.

From the data available, FAME blended with existing ex-wharf 0.5% VLSFO base stocks is seen to eliminate issues of sulphur compliance. Other parameters such as Al+Si, sodium and vanadium are also seen to blend linearly with associated reductions.

Viscosities are also seen to reduce due to the FAME portion and in general the fuels are seen to be very stable when considering TSP (highest value 0.03% Wt).

No fuels identified as VLSFO biofuel blends during the period assessed were seen to be off specification against ISO 8217 RMG 380.

Total acid number was, however, identified as being elevated in some blends, this possibly due to the naphthenic nature of the crude processed for the VLSFO itself but perhaps also due to the presence of ageing or old biofuels which in time form fatty acids as they oxidise, becoming rancid.

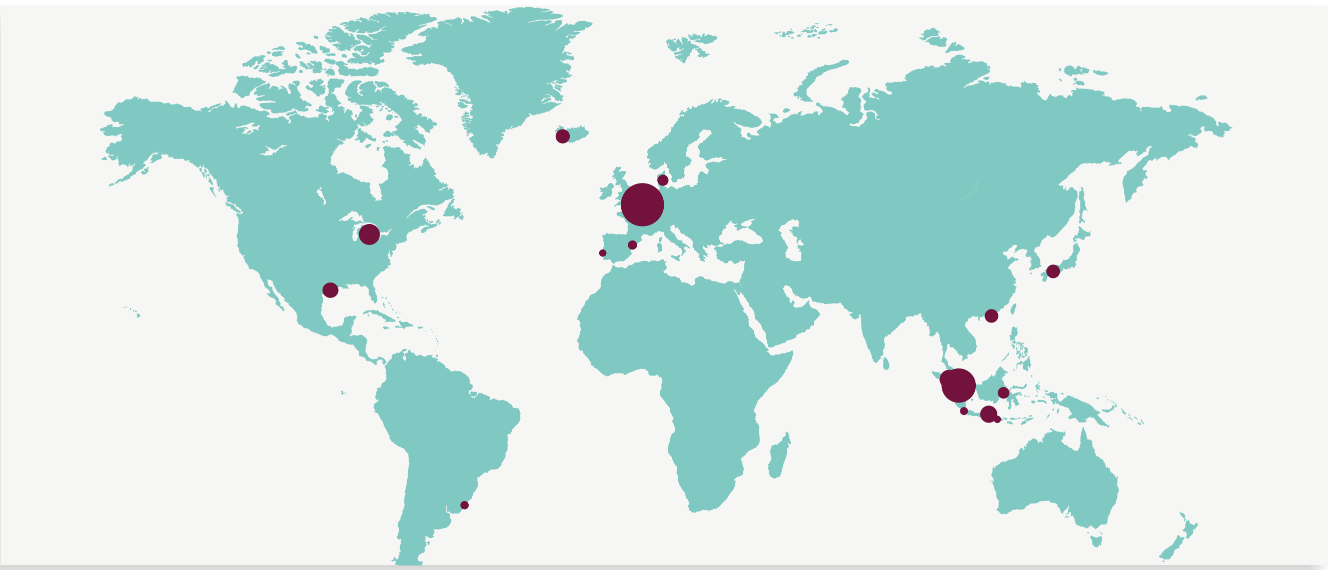


Figure 17: Distribution of B7-B100 marine fuels (FAME)

Distillate blends and B80+ fuels

MGO blends of biofuels are more prevalent than VLSFO blends and show similar linear blending traits for most parameters, however pour point is seen to increase with a corresponding increase to the blend percentage of FAME with levels of between +6 to +12°C not uncommon for FAME rich fuels (B80+), no doubt as a result of the feedstocks likely being used as cooking oils (see figure 18). This type of biodiesel is commonly known as UCOME or used cooking oil methyl esters.

Cloud points and CFPPs are also seen to be in close proximity to the pour point but given the levels noted (especially for UCOME), it is highly likely that heating the fuel will be necessary to prevent operational difficulties onboard the vessel and will require storage tanks with heating coils.

However, too much heating can also create issues. Similarly to VLSFO, FAME (and UCOME) blends can be termed 'goldilocks fuels', where, just like the porridge in the children's story, it mustn't be too hot or too cold but stored 'just right'. Too much heat can result in oxidisation of the biofuel where initially peroxides will form, and then as they continue to decay, they can form organic acids, aldehydes, alcohols and sometimes sticky polymers.

FAME Level %	Average Pour Point (°C)
20-40	-3
41-80	+1
81-100	+8

Figure 18: Pour point of MGO/FAME blends

Hidden losses: Density short lifting

Prices have increased in recent months, so the practice of density short lifting (and as a result the impact with any associated losses) must remain a very important consideration.

Data available to Integr8 Fuels continues to identify several key locations in the world with endemic variances for both VLSFO and MGO.

A comparison of price across competing ports is also possible. For example, a buyer in the market for MGO comparing Hong Kong and Singapore may immediately be drawn towards the seemingly lower price in Hong Kong at USD789 but once the losses of 2.4% unwind, they will find themselves with a product that prices above the USD800 of Singapore, a figure which will not vary due to the supplies being exclusively measured using mass flow meter (see figure 19).

A smart buyer of bunkers for a sizeable fleet should make understanding this landscape (see figure 20) a priority and adjust buying accordingly, as the impacts of losses associated could be very significant across a larger fleet.

Port	VLSFO Var (%)	Avg $/MT (180 Days)	Adjusted $/MT (Var)	MGO Var (%)	Avg $/MT (180 Days)	Adjusted $/MT (Var)
Hong Kong	-1.4	620	629 (+9)	-2.4	789	$808 (+19)
Sri Lanka	-0.4	666	669 (+3)	-1.1	931	$941 (+10)
Khorfaikken	-0.5	600	603 (+3)	-0.6	885	$890 (+5)
Zhoushan	-0.2	619	620 (+1)	-0.3	836	$839 (+3)
Singapore* MFM	-	610	610 (NIL)	-	800	$800 (NIL)

Figure 19: Impact of density variances by port

*Singapore variance not applicable due to mass flow meter being used for custody transfer

Port	Average Density Short Lift (%)	Average VLSFO price per MT (USD)	Average Loss per MT (USD)	Average Loss per 100K MT (USD)	Worse Case Supplier Variance (%)	Worse Case Loss per 100K MT (USD)
Hong Kong	-1.4	629	9	90K	4.1	410K
Sri Lanka	-0.4	669	3	30K	2.4	240K
Khorfakken	-0.5	603	3	30K	3.1	310K
Zhoushan	-0.2	620	1	10K	0.5	240K
Singapore	-	610	-	NIL	-	NIL

Figure 20: VLSFO density losses projected across a fleet

A changing of the guard?

Recently, I have often paused and found myself thinking that we have reached a crossroads. The industry may finally move from the opacity (and endemic mistrust) of the past to a more professional, transparent and traceable future because of the uptick of alternative fuels and the strict requirement for owners to report the verified amounts of emissions to, from and between EU ports.

Of course, not all suppliers will embrace alternative fuels or mandatory mass flow meters (as recently announced in Rotterdam, Antwerp and Brugge ports) but those who do will quickly realise their tried and tested practices will be challenged by the end users who will demand they demonstrate and certify sustainability. This peer pressure will filter up the supply chain accordingly and drive change.

Supply Chain

The supplier of alternative fuels will need to be able to categorically prove the biocomponent in their fuels is sustainable and must be able to provide this to their customer. If this is not possible then the alternative fuels, which are generally bought at premiums to conventional fuels, would not be counted in any emissions saving, counting the same as mineral fuels.

Documentation

One of the biggest challenges with the changing of the guard will be the need to retrain and educate all stakeholders in the industry, from barge deck hand, to buyer, and beyond.

Starting on board the barge, one of the first immediate changes will be the need to define the product and grade properly on the bunker delivery note (BDN) with the reasoning behind this being the need to be able to allocate a carbon factor to the fuel supplied. This will equate to approximately 3.15 tonnes of carbon dioxide emitted per tonne of mineral fuel consumed, however this varies by type of fuel (see figure 21).

Inevitably, this will be a challenge for all physical supplier and vessel crews alike with retraining necessary to ensure no ambiguity on the BDN for the verifier. Indeed, it would be prudent for end users to add independent checks to any bunker quantity survey (BQS) scope requirement or even move to electronic bunker delivery notes to prevent such occurrences by minimising the possibility of human error.

Of course, this is not the only requirement for a BDN. In the case of biofuel blends it will also be essential to ensure that the quantities (including units of measurements) are traceable and indeed match any proof of sustainability (or POS) that is issued by a certified supplier. Should this documentation not be traceable then the chain of sustainability would be broken, with the verifier reverting to the mineral carbon factors noted above rather than a fuel free of CO2.

Fuel Type	Grade	Carbon Factor (CF) GCo2e/g Fuel
Distillate	DMA, DMB, DMZ	3.206
Residual (Light Fuel Oil)	RMA, RMB, RMD	3.151
Residual (Heavy Fuel Oil)	RME, RMG, RMK	3.114

Figure 21: Carbon factors of fuels (per MEPC 80)

Conclusion

Thankfully the landscape of fuel quality remains very good. However, as we have identified in this report, pockets of problems do exist and as a result, data-driven buying continues to be the first line of defense to proactively protect buyers against many of the issues we see in the industry.

Turning our attention to the future, the lessons learned in the past have to be taken onboard. Doing nothing remains an option right now, however in time our relevance in the industry will be challenged and eventually we will fade into insignificance.

The word relevant in my opinion is an excellent way of describing the challenges to individuals and businesses alike.

- Ensuring that our training and knowledge is relevant to the new world of alternative fuels.

- Ensuring that our fuels are bought and sold to the new specifications that are relevant to the lessons learned since IMO 2020 and the future fuels on the horizon.

- Ensuring our business strategies remain relevant to the continued changes in legislation that are inevitable as part of the industry drive to decarbonise.

Ultimately it is about embracing the future, hurdling the obstacles on the way (of which there will be many) and believing that we may emerge a better and more professional industry as a result.

It remains to be seen if we can achieve this. For the sake of many, I hope we can.

For further information about this report or to discover how Integr8 can support your bunker procurement:

Email:
marketing@integr8fuels.com

Visit:
www.integr8fuels.com

Chris Turner
Bunker Quality & Claims Manager
Email: chris.t@integr8fuels.com

Chris joined Integr8 Fuels in 2017, spending several years in Singapore before relocating to Dubai.

With a career spanning over 30 years in the oil & shipping industries, Chris has a vast amount of experience including laboratory management, physical supply, bunker broking, trading and, more recently, providing technical supervision of exclusive buying for owners, charterers and operators, including the development and design of online bunker resources.

Chris is also a member of the IBIA technical working group, and a regular speaker, moderator and panel member at many global bunkering conferences worldwide.